Assessment of Operative Blood Loss and the Factors Affecting it in Tonsillectomy and Adenotonsillectomy

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Abstract To estimate the average operative blood loss in tonsillectomy and adenotonsillectomy and the various factors affecting it. A prospective study of estimation of blood loss in 100 patients who underwent tonsillectomy and adenotonsillectomy. Data collected included the age, sex, operative indication, clotting time, Hb levels and usage of pre-operative antibiotics. Cold knife dissection method for tonsillectomy and curettage method for adenoidectomy were used. Measurement by calorimetric method of estimation being simple and accurate was used for estimation. Study undertaken at a tertiary referral hospital catering to an urban, semi-urban and rural populace. Blood loss was more in males and increases as age advances both in adenotonsillectomy and tonsillectomy. Blood loss was more in fibrosed tonsils, at lower hemoglobin levels and at higher clotting times. It was less in cases who received pre-operative antibiotics. The average blood losses in males and females during tonsillectomy were 106.91 and 96.26 ml respectively. In adenotonsillectomy, the average blood losses in males and females were 81.44 and 76.82 ml respectively. In our series we found that blood loss in tonsillectomy and adenotonsillectomy depended on various factors like age, sex, the type of

tonsillitis, method of dissection, hemoglobin concentration, clotting time and the use of antibiotics. All these factors must be taken into consideration while taking up patients especially those who cannot tolerate blood loss, for surgery.

Keywords Tonsillectomy · Adenotonsillectomy · Blood loss · Cold-knife dissection · Calorimetric method

Introduction

Although tonsillectomy is one of the most commonly performed surgeries, a review of literature reveals only a few articles dealing with the study of intraoperative blood loss in tonsillectomy and adenotonsillectomy and the factors influencing it. Estimation of blood loss during tonsillectomy is difficult but important especially in patients who cannot tolerate blood loss, e.g., children, patients with anemia or factor VIII deficiency and patients receiving anticoagulant therapy. Also, in children the normal physiological mechanisms are less adaptable to a rapid blood loss and breakdown of these compensatory mechanisms may be initiated by a smaller loss than in adults. This and the fact that adenotonsillectomy is a common operative procedure in children prompted this study.

There are many proven methods of tonsillectomy that include cold-knife dissection, LASER, guillotine, snare with suture, suction cautery, hot-knife dissection, microdissection, bipolar and unipolar electrocautery and most recently described bipolar electrosurgical scissors [1]. Though surgeons are trying newer and more effective methods, the cold knife technique has remained the standard procedure for many years. To measure operative blood loss accurately and continuously is difficult

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especially in adenotonsillectomy. Several methods of estimation such as calorimetric method of estimation (swab weighing technique), repeated volume determination, weighing the patient etc. are based on different principles. The calorimetric method of estimation is the simplest method of measuring blood losses and is relatively accurate especially in adenotonsillectomy. Hence we have adopted the same method in assessing the blood loss in adenotonsillectomy.

Materials and Methods

Fifty cases of adenotonsillectomy and fifty cases of tonsillectomy performed for tonsillitis were taken up for measuring the quantity of blood loss in this prospective study. A random selection of cases was done. All patients selected below 15 years had disease of the adenoids and tonsils and they underwent adenotonsillectomy and those above 15 years had tonsillar disease alone and underwent only tonsillectomy.

Pre-operative evaluation included a thorough history and physical examination with emphasis on past episodes of bleeding and family history. Patients with bleeding disorders, malnutrition and co-existing systemic diseases were excluded from the study. Pre-operatively, the hemoglobin level, total and differential blood counts, the clotting time and blood group were determined. Patients with low hemoglobin (Hb) concentration and high clotting time were also taken to see its effect on blood loss. One group of patients received pre-operative antibiotic therapy while the other did not. The average operating time was 13.4 min.

Procedure

All the cases were operated under general anesthesia with endotracheal tube after proper premedication with atropine, phenergan and pethedine. The oral tube was used for adenotonsillectomy and the nasal tube for tonsillectomy. In cases of adenotonsillectomy, the adenoidectomy was performed first.

Adenoidectomy was done by curettage and tonsillectomy by cold-knife dissection. Before starting the surgery, a good amount of cotton and ribbon gauze was taken, weighed and sterilized. The weight was always kept constant at 20 g. The suction bottle including the rubber tube was cleaned and emptied completely before starting the operation. A known quantity of saline (150 ml) was taken in the bowl and used for intermittent suction, to prevent blockage of the suction tube.

To start with, the oral cavity was wiped out with separate gauze (not the measured one), to reduce the quantity of saliva and secretion. Administering atropine as

premedication half an hour before surgery also reduced the secretion of saliva.

During surgery, all the blood lost was collected in the suction bottle. After adenoidectomy a length of measured ribbon gauze piece (which was taken from the measured pad) was packed in the nasopharynx and both nostrils and left in position. Tonsillectomy was then performed by dissecting the tonsil from the superior to inferior pole. Bleeding points were immediately clamped and ligated. The tonsillar fauces were packed with cotton taken from the measured pad. Once the tonsils were snared off, they were squeezed thoroughly into the gauze (which was again taken from the measured pad) and the tonsils discarded. Care was taken to see that the linen was not soiled with blood. All the packs and cotton balls were kept on a physical balance for weighing.

After ligating the bleeders, the nostrils and nasopharynx were sucked. Then all the saline taken in the bowl was sucked into the suction bottle. The suction tube was raised above the level of the suction bottle to ensure that all the fluid was emptied into the suction bottle. The quantity was then measured by pouring it into the measuring cylinder.

Thus all the blood lost was collected either in the suction bottle or cotton and gauze. All the soiled gauzes and cotton balls together with unused cotton balls are placed on the physical balance and weighed. The difference in weights is the weight of blood lost in cotton and gauze. This was converted into milliliters by dividing the weight by specific gravity, which is 1.055.

Calculations

Weight of the cotton balls before use = y g

Weight of the cotton balls soaked with blood = x g

Weight of the blood lost = $x - y$ g

Specific gravity of blood = 1.055

Quantity of blood lost = $(x - y) / 1.055$ g

Amount of fluid (blood + known quantity of saline) collected in suction bottle = z ml

Amount of saline sucked in the bottle = 150 ml

So quantity of blood in suction bottle = $z - 150$ ml

Total quantity of blood lost = $(x - y) / 1.055$ g + $z - 150$ ml

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Results and Observations

In our study, we found that blood loss increased with increasing age both in adenotonsillectomy and tonsillectomy. It was observed that the average blood loss in males during tonsillectomy was 106.91 ml whereas the average

blood loss in females during tonsillectomy was 96.26 ml. In cases of adenotonsillectomy, the average blood loss in males was 81.44 ml and that in females was 76.82 ml. The average blood loss (in milliliters) in males and females in the 5–9 year age group was 79.79 and 72.70, respectively, in the 10–14 year group, 84.23 and 78.12, in the 15–19 year group 92.63 and 81.96, respectively. This is in contrast with higher losses in adults. Adenoidectomy was performed along with tonsillectomy only in the 5–14 year age group. In all age groups, blood loss was more in males than in females except in the 20–24 group where the blood loss was marginally more (3.05 ml) in females (Table 1). Bleeding was highest in fibrosed tonsils (Table 2). In patients in whom adenotonsillectomy was done, the average blood loss was 79.13 ml and in those underwent tonsillectomy was 101.58 ml. This is due to the fact that all of the patients undergoing adenotonsillectomy were in the 5–14 year age groups in whom the operative blood loss is less. It also showed that bleeding was more between 8 and 9 g% of Hb whereas less in cases with Hb concentration of 14.0 g% and higher (Table 3). Blood loss was highest when the clotting time was between 8 and 9 min and least in cases where the clotting time was between 2 and 4 min (Table 4). Blood loss was less in patients who received pre-operative antibiotics (Table 5).

The maximum blood loss in tonsillectomy was 177.83 ml in a male patient aged 44 years while the least blood loss was 47.78 ml in a female patient aged 16 years. The maximum blood loss during adenotonsillectomy was 94.95 ml in a female patient aged 10 years, while minimum blood loss was 53.03 ml in a female patient aged 11 years.

Discussion

Though the earliest description of tonsillectomy in the literature dates back to the first century AD during the Roman Empire, according to a review, the word

Table 2 Blood loss relevant to clinical features

Findings	No. of cases	Average blood loss in ml
Fibrosed tonsils	21	118.24
Hypertrophied tonsils	20	88.16
Quinsy	4	87.48
Keratoses of the tonsil	3	101.04
Cyst in the tonsil	1	83.76
Tonsillolith	1	96.18

‘tonsillectomy’ first appears in the text article by Robert C. Myles of New York in 1904 [2]. A wide variety of surgical techniques for tonsillectomy and adenoidectomy are available and all are essentially safe and effective. Though surgeons are trying newer and more effective methods, the cold knife technique has remained the standard procedure for many years. Though the anatomy of the tonsil allows operations under direct vision, this is not the case in adenoidectomy. Scrupulous attention to ligation of bleeding-points will normally take care of the tonsil bed, but the adenoid bed cannot be reached in the same way and thus even in the most skilled hands there is likely to be appreciable loss of blood from it.

To measure intra-operative blood loss accurately and continuously is difficult especially in adenotonsillectomy. Various methods are available for measurement of blood loss. Methods based on different principles such as swab weighing, repeated volume delumination, weighing the patient etc. are available. Each technique has certain individual advantages. The ideal method should meet the following requirements.

1. Simple technique with minimal equipment
2. Accurate results, irrespective of amount of blood loss
3. Continuous or frequent intermittent readings of actual blood loss
4. Demand minimal training of the operator
5. The equipment should be mechanically reliable

Table 1 Blood loss versus age and sex

Age in years	Total no. of cases	Males	Average blood loss in ml	Females	Average blood loss in ml
5–9	21	15	79.79	6	72.70
10–14	29	10	84.23	19	78.12
15–19	16	4	92.63	12	81.96
20–24	16	8	97.47	8	100.52
25–29	4	3	106.69	1	104.13
30–34	4	3	93.62	1	116.15
35–39	4	2	115.17	1	131.35
40–44	4	3	142.12	1	135.81
45–49	2	2	132.84	0	–

Table 3 Blood loss and hemoglobin concentration in tonsillectomy and adenotonsillectomy

Hb concentration (g%)	Tonsillectomy			Adenotonsillectomy		
	Males	Females	Average blood loss in ml	Males	Females	Average blood loss in ml
8.0–9.75	3	5	110.54	3	6	84.7
10.0–11.75	12	11	104.46	16	13	75.95
12.0–13.75	7	9	97.82	5	3	75.69
14.0 and above	3	0	92.36	1	1	82.39

Table 4 Blood loss and clotting time in tonsillectomy

Coagulation time (min)	Tonsillectomy			Adenotonsillectomy		
	Males	Females	Average blood loss in ml	Males	Females	Average blood loss in ml
2–4	7	5	91.27	3	1	75.00
4–6	6	12	94.40	8	19	78.21
6–8	11	7	113.30	13	5	81.61
8–9	1	1	117.18	1	–	75.30

Table 5 Blood loss and antibiotic treatment in adenotonsillectomy

Pre-operative treatment	No. of cases	Average blood loss in ml
With antibiotic	46	80.75
Without antibiotic	54	97.06

6. There should be no danger to the patient or operator, e.g., from radiation
7. May be performed under adverse conditions such as the battle field

Ruggles [3] in his study measured blood loss by radioiodine I^{131} labeling. In their series, Holden and Maher [4], and Haq and Dundee [5], used the volumetric and gravimetric method for measurement of blood loss. Shalom [6], Callanan et al. [7], and Boliston and Upton [8], in their series used the swab method for estimation of blood loss. Measurement by swab weighing technique bears a fairly constant relation to estimations by blood volume and is the simplest and relatively the most accurate. Hence we have adopted the same method in assessing the blood loss in adenotonsillectomy.

Callanan et al. [7], reported a blood loss of 130 ml in tonsillectomies in their control group. Boliston and Upton [8], report a blood loss of 152 ml in their control group. In the series by Shalom [6], the average blood loss in tonsillectomy in adults was 179.3 ml (range 7–349 ml). de Reynier [9] found an average loss of 165 ml in 12 adults, when the operation was performed under general anesthesia but only 16 ml when performed under local anesthesia. Maier and Bogue [10] measured the blood loss by the swab weighing technique and found an average loss of 130 ml (range 20–449 ml). In ten cases the loss was over 200 ml.

They found that the older the children the greater were the losses. Ruggles [3] measured blood loss in tonsillectomy and adenoidectomy by blood volume studies utilizing 51_{cr} in 17 children. He found an average loss of 119 ml. Mann et al. [11] reported tonsillectomy by electrocoagulation, which markedly diminished blood loss. They also compared blood loss by electrocoagulation method (hot) versus dissection method (cold) in 95 patients. According to them average blood loss by hot method is 11.8 ml and in cold is 66.3 ml for each tonsil. Carithen et al. [12] reported that 1.2% of tonsillar hemorrhage and 3.2% of adenoidal hemorrhage were severe, though he has not assessed the exact quantity of blood loss.

In our study the average blood loss varied with different conditions of the tonsils and adenoids. Maximum blood loss was observed in fibrosed tonsils. This could be attributed to the fact that with more fibrosis, the lesser the contraction of the vessels, thus resulting in more blood loss (118.24 ml). Holden and Maher [4], also reported increase in blood loss on tonsillectomy in fibrosed tonsils. Four cases of quinsy were initially subjected for incision and drainage followed by antibiotics. They underwent tonsillectomy 1 month later. The average bleeding in those cases was 87.48 ml. In cases of hypertrophied tonsils, the average bleeding was 88.16 ml which when compared to the loss in fibrosed tonsils is less.

Since the adenoids were not operated upon independently the blood loss in adenoidectomy alone could not be determined. Holden and Maher [4], report a mean blood loss of 77.5 ml in their short series in which adenoidectomy alone was done (14 cases). The blood loss from adenoidectomy is largely unavoidable though some surgeons pack the postnasal space while proceeding with

tonsillectomy. Some prefer the use of sinoscopes endonasally to identify and cauterize the bleeders.

Age

It is clearly shown that older the child the greater the blood loss in cases of adenotonsillectomy and tonsillectomy. These findings correlate well with those of Shalom's [6] and Holden and Maher's [4], series of adenotonsillectomy.

Sex

It was found that bleeding was more in males during adenotonsillectomy and tonsillectomy. But Shalom [6] in his series found that there was no significant difference related to the sex of the patients. This difference in blood loss in males and females in our series could be attributed to their weight, the males being usually heavier.

Hemoglobin Concentration and Clotting Time

The blood loss was more when the hemoglobin concentration was less. The reason for this could not be ascertained. This could be due to hemodilution, leading to more bleeding. This indicates that the anemia has to be corrected preoperatively to reduce intraoperative blood loss. Both in cases of adenotonsillectomy and tonsillectomies, the blood loss increased as the clotting time increased. Hence we could state that sealing of the capillaries after tonsillectomy was delayed when the clotting time was more giving rise to more blood loss.

Blood Loss Distribution

It may be stated that the blood loss in our series corresponds more or less with the other studies quoted. The average blood loss during adenotonsillectomy in our series was 79.13 ml and in tonsillectomy, 101.58 ml. In this series, the maximum blood loss was not more than 180 ml as compared to that of other observers wherein the blood loss had crossed 200 ml in some cases.

Antibiotic Therapy

The average blood loss in 46 patients who received antibiotics was 80.75 ml whereas in the other group of 54 patients who had not received the antibiotics the average blood loss was 97.06 ml. It is seen that bleeding was less after an antibiotic course.

Imperfections of anaesthetic technique, which produce laryngospasm, gagging or straining, may contribute materially to blood loss [4]. The dissection skills of the operating surgeon also plays a role in operative blood loss.

Blood loss is less in the hands of Consultants than junior staff [7]. There are various methods described to make tonsillectomy as bloodless as possible. Pre-medication with vitamin K reduces the tendency to bleed and the use of thromboplastin on sponges correlates with smaller losses [10]. In a trial of 84 adult patients by Boliston and Upton [8], undergoing tonsillectomy, a subcapsular injection of 10 ml of 0.5 per cent lignocaine with adrenaline halved the blood loss and made dissection easier. A significantly higher systolic pressure and heart rate in the injected patients were thought to be due to the systemic effects of adrenaline. Broadman et al. [13], have demonstrated the benefits of using peritonsillar infiltration with adrenaline and conclude that infiltrations should be performed with either normal saline containing epinephrine (1:200,000) or lidocaine containing epinephrine (1:200,000). Rasgon et al. [14], report that dissection is easier with peritonsillar injections with epinephrine and that it can be used safely with the appropriate inhalation anesthetics. Arora and Manford [15], studied the effectiveness of ethamsylate in reducing intraoperative blood loss and found no significant reduction in intraoperative blood loss though some studies mention a definite benefit in terms of decreased intraoperative blood loss. Earlier studies have shown that bismuth subgallate added to gauze swabs in tonsillectomy reduces the time to achieve haemostasis and probably reduces the risk of postoperative haemorrhage [7]. But Sorensen et al. [16], question its efficacy and ascribe the effect observed in previous studies probably to the effect of adrenaline. In a series by Blomgren et al. [1], of electrodissection tonsillectomy, the mean intraoperative blood loss was 29.1 ml which was clearly associated with the tonsillectomy indication, being smallest in patients operated on because of tonsil hypertrophy and largest in those operated on because of peritonsillar abscess. They conclude that this technique is fast and resulted in little intraoperative bleed but come with two major drawbacks: long lasting postoperative pain and post-tonsillectomy haemorrhages. But Trent [17] in his series does not record any such advantages and recommends epinephrine-injection tonsillectomy as a safe and expedient operation. Studies have shown that the intraoperative blood loss and episodes of postoperative hemorrhage are minimal with the Harmonic scalpel, which allows cauterization and sealing of blood vessels during the surgical procedure that adequately control bleeding both during and after tonsillectomy and benefits patients who cannot tolerate blood loss (e.g., children, patients with anemia or factor VIII deficiency and patients receiving anticoagulant therapy). Compared with standard dissection, the Harmonic scalpel method appears to be associated with less pain after surgery; compared with electrocautery, it seems to provide a reduction in pain throughout the postoperative recovery period [18]. In one of the largest

prospective double-blind randomized controlled trial to date (151 patients) comparing KTP laser with standard dissection tonsillectomy, by Kothari et al. [19], they found that there was significantly less peroperative haemorrhage if tonsillectomy was performed using the KTP laser, but it did caused more postoperative pain, more depression in mood and a higher rate of both reactionary and secondary haemorrhage, which was not significant when compared with conventional dissection and conclude that KTP laser tonsillectomy offers no benefit apart from less intraoperative bleeding over standard dissection tonsillectomy. In another study, Jackel et al. [20], state that CO₂ LASER microsurgery improves the precision of tonsillectomy and provides a maximum protection for the peritonsillar tissue; the incidence of severe bleeding events being markedly reduced. They recommend LASER tonsillectomy for patients with clotting disorders or those requiring a particularly exact preparation technique.

Conclusion

In the present study the blood loss in 100 cases was measured. Detailed studies need to be done on the factors leading to blood loss in tonsillectomy. This will lead to a protocol for replenishment of lost fluid and blood by adequate hematinics and nutritional support that will help the patient in the recovery period. The average blood loss was more in males both in adenotonsillectomy and tonsillectomy series. The average blood loss during adenotonsillectomy was only 79.13 and 101.58 ml in tonsillectomies, which correlated well with similar studies conducted by various workers stated in the literature. Preoperative correction of anemia will reduce blood loss. Pre-operative antibiotics will also reduce the amount of blood loss.

References

1. Blomgren K, Qvarnberg YH, Valtonen HJ (2001) A prospective study on pros and cons of electrodissection tonsillectomy. *Laryngoscope* 111:478–482
2. Koempel JA (2002) On the origin of tonsillectomy and the dissection method. *Laryngoscope* 112:1583–1586
3. Ruggles RL (1960) Blood loss during adenoidectomy and tonsillectomy measured with radioisotopes. *Ann Otol* 69:360
4. Holden HB, Maher JJ (1965) Some aspects of blood loss and fluid balance in paediatric adenotonsillectomy. *Br Med J* 2:1349–1351
5. Haq IU, Dundee JW (1968) Studies of drugs given before anaesthesia. XVI: oral diazepam and trimeprazine for adenotonsillectomy. *Br J Anaesth* 40:972
6. Shalom AS (1964) Blood loss in ear nose and throat operations. *J Laryngol Otol* 78:734
7. Callanan V, Curran AJ, Smyth DA, Gormley PK (1995) The influence of bismuth subgallate and adrenaline paste upon operating time and operative blood loss in tonsillectomy. *J Laryngol Otol* 109:206–208
8. Boliston TA, Upton JJ (1980) Infiltration with lignocaine and adrenaline in adult tonsillectomy. *J Laryngol Otol* 94(11):1257–1259
9. de Reynier JP (1959) Hemorrhage during tonsillectomy. *Pract Otorhinolaryngol* 21(1):18–23
10. Maier HL, Bogue CR (1960) Measurement of blood loss during tonsillectomy and adenoidectomy. *Northwest Med* 59:910–913
11. Mann DG, George CST, Scheiner GD, Imber P, Mlynarczyk FA (1984) Tonsillectomy-some like it hot. *Laryngoscope* 94:677–679
12. Carithen JS, Gebhart DE, Williams JUA, Columbus OH (1987) Postoperative risks of paediatric tonsilloadenoidectomy. *Laryngoscope* 97(4):422–429
13. Broadman LM, Patel RI, Feldman BA, Sellman GL, Milmo G, Camilon F (1989) The effects of peritonsillar infiltration on the reduction of intraoperative blood loss and post-tonsillectomy pain in children. *Laryngoscope* 99(6 Pt 1):578–581
14. Rasgon BM, Cruz RM, Hilsinger RL Jr, Korol HW, Callan E, Wolgat RA, Selby JV (1991) Infiltration of epinephrine in tonsillectomy: a randomized, prospective, double-blind study. *Laryngoscope* 101(2):114–118
15. Arora YR, Manford MLM (1979) Operative blood loss and the frequency of hemorrhage associated with adenotonsillectomy in children: a double-blind trial of ethamsylate. *Br J Anaesth* 51:557–561
16. Sorensen WT, Henrichsen J, Bonding P (1999) Does bismuth subgallate have haemostatic effects in tonsillectomy? *Clin Otolaryngol Allied Sci* 24(1):72–74
17. Trent CS (1993) Electrocautery versus epinephrine-injection tonsillectomy. *Ear Nose Throat J* 72(8):520–522
18. Wiatrak BJ, Willging P (2002) Harmonic scalpel for tonsillectomy. *Laryngoscope* 112:14–16
19. Kothari P, Patel S, Brown P, Obara L, O'Malley S (2002) A prospective double blind randomized controlled trial comparing the suitability of KTP laser tonsillectomy with conventional dissection tonsillectomy for day case surgery. *Clin Otolaryngol Allied Sci* 27(5):369–373
20. Jackel MC, Petzold S, Dimmer V, Mall G, Reck R (2003) Tonsillectomy by CO₂ laser microsurgery—an analysis of clinical and morphological data. *HNO* 51(8):634–639